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Foreign Animal Disease Report

United States
Department of Agriculture

Emergency
Programs

Animal and Plant
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Veterinary Services



Number 10-3

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Notice to Readers

We need your help to maintain an up-to-date mailing list for the Foreign Animal Disease (FAD) Report. Please check the address on the mailer you received and notify us of any necessary change. Also, please indicate the total number of copies needed for local or unit distribution. This is especially important for Veterinary Services (VS) area veterinarians-in-charge, who are being asked to distribute a copy to each veterinary medical officer and animal health technician in their areas. It is similarly important for teachers of foreign animal diseases in the colleges of veterinary medicine to indicate the number of copies needed for distribution to their students and key faculty members. Be a miser! Help us conserve Federal dollars by notifying us immediately when you no longer wish to receive one or more copies of the FAD Report. (Dr. E. I. Pilchard, Editor, FAD Report, Room 760, Federal Bldg. Hyattsville, MD 20782; Phone 301 436-8087)

Current Events

Vesicular Stomatitis

The vesicular stomatitis outbreak reported earlier this year has continued in several Midwestern and Western States. The disease was confirmed in Montana, Nebraska, South Dakota, and Washington after September. Cattle and horses were infected in Montana and Nebraska. A horse was infected in South Dakota. VS occurred in two Washington dairies after the arrival of cattle purchased at a dispersal sale in Colorado. Similarly, VS occurred in dairy heifers in southern New Mexico within 2 days after their arrival from Idaho.

Investigations were conducted and samples submitted from the following number of premises in States where VS was confirmed during the period June 2 to November 1, 1982.

State	Total Premises <u>Investigated</u>	Laboratory Tests for VS		
		Positive	Negative	Pending
Colo.	405	301	100	4
Wyo.	75	44	31	0
Utah	25	23	1	1
Idaho	104	70	29	5
N. Mex.	37	31	5	1
Ariz.	9	6	3	0
Mont.	26	13	12	1
Neb.	6	4	2	0
S. Dak.	1	1	0	0
Wash.	11	2	9	0
Total	699	495	192	12

Investigation of 46 suspicious cases in California, Iowa, Kansas, Louisiana, Minnesota, Missouri, North Dakota, Oregon, and Texas failed to disclose the presence of VS. Laboratory tests are continuing on specimens from Colorado, Utah, Idaho, New Mexico, and Montana. (Dr. W. E. Ketter, 301 436-8091)

Haitian
ASF Update

The cooperative program to eradicate African swine fever (ASF) from Haiti, reported in FAD Reports 10-1 and 10-2, is progressing according to plan.

Haitian brigades--with U.S. and Canadian cooperators--completed an eastward sweep to the border of the Dominican Republic. They then continued southward across the Massif du Nord Mountain system. The brigades are now working southward from fronts located near Gonaives on the northwestern coast of the Golfe de la Gonâve, Pont Sonde near the central gulf coast town of St. Marc, and Hinche on the Plateau Central near the Dominican Republic border. Depopulation has not been completed on the Ile de la Tortue.



Arrows on map represent direction of progress by eradication brigades.

By October 28, 1982, a total of 87,506 swine had been eliminated and \$2,249,815 had been paid in indemnity. (Dr. J. A. Downard, 301 436-5256)

Suspected
Foreign
Animal
Diseases

A total of 77 occurrences of unusual animal disease conditions in 21 States was investigated by specially trained APHIS Foreign Animal Disease (FAD) diagnosticians during the period July 1 to September 30, 1982. Involved were 21 pet birds and poultry, 28 cattle, 16 horses, 8 swine, 3 sheep, and a goat. (Dr. W. E. Ketter, 301 436-8091)

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Genetically
Engineered
FMD Vaccines [2].

✓ [Foot-and-mouth disease] (FMD) virus has been [studied at the molecular level at USDA's Plum Island Animal Disease Center] and several other laboratories around the world for many years. Through these studies, several years ago, one of the four virus coat proteins of foot-and-mouth disease virus was shown to produce immunity when made into a [vaccine]. Cattle and swine were protected with a vaccine formulated from this virus protein. Approximately 18 months ago, staff of Plum Island Animal Disease Center (PIADC) and Genentech, a genetic engineering firm located in California, announced production of this protein through gene splicing or recombinant DNA technology. In this work, the gene of the virus of foot-and-mouth disease, which contains the genetic coding information for the immunizing protein, was spliced into a special plasmid from a modified strain of the bacterium, E. coli. When the bacterium containing the engineered plasmid is propagated, the bacteria divides every 20 minutes and in 18 hours can reach a concentration of 10^{12} organisms per milliliter of culture fluid. When the bacteria are stimulated to synthesize the viral protein, they produce about 1-2 million molecules per bacterium. The bacterial cells are then lysed and the protein is collected, purified, and formulated into a vaccine. Livestock have been vaccinated with protein produced by the above recombinant procedure and, protection has been demonstrated against FMD infection (D. G. Kleid et al., Science 214: 1125-1129, Dec. 4, 1981).

The sequence of 212 amino acids in the immunizing protein has been determined for several vaccine strains of FMD virus. Also, scientists in Germany have shown that the central part of the protein includes a principal immunizing site. Using this information, scientists at Scripps Institute in California and the Animal Virus Institute in Pirbright, England, have synthesized a peptide 20 amino acids long. When it was coupled with haemocyanin, an antigenic carrier protein, and adjuvanted with an oil or aluminum hydroxide adjuvant, it induced neutralizing antibodies in guinea pigs and their immunity withstood challenge with virus. This vaccine was reported to produce antibodies in cattle. The immunity of such animals was not challenged. (J. L. Bittl et al., Nature 298: 30-33, July 1, 1982).

Neither of the processes described has been commercialized, and it is therefore too early to conclude if one or the other will be superior. Both methods offer a distinct advantage of safety over whole virus vaccine production because infectious virus is not required to produce the protein. This eliminates the danger of escape of the virus from the vaccine production laboratory or escape through inadequate inactivation of virus in vaccines. (Dr. J. J. Callis, 516 323-2500)

Animal
Importation
Planned

Plans are progressing to import Limousin cattle into the United States through the H. S. Truman Animal Import Center (HSTAIC), Fleming Key, Florida. APHIS veterinarians D. E. Herrick and M. R. Crane visited France during the week of August 15, 1982, to discuss importation plans with French veterinary officials. Farms from which the cattle are to originate and the quarantine export station at Brest were inspected. Importation of cattle from France is restricted because that country has not been declared free of foot-and-mouth disease. The cattle will have to undergo quarantine at HSTAIC before they can enter the United States.

A team of U.S. Department of Agriculture veterinarians and animal health technicians departed for France on September 26 to initiate the first round of on-the-farm testing of the French cattle. The first collection of test samples was shipped to the PIADC on October 8. If the program continues as scheduled, the French cattle will enter quarantine at the Brest facility about November 15. The cattle are tentatively scheduled to enter quarantine at HSTAIC during the week of December 20 to initiate the 90-day quarantine period at that facility. It is expected that 50 head of Limousin cattle will be shipped to the United States. This will be the first importation of European cattle through HSTAIC. (Dr. H. Kryder, 301 436-5873)

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Many Exotic
Birds Carry
VVND [12].

Parrots aren't the only birds capable of bringing exotic Newcastle disease into the United States, according to diagnostician Dennis Senne of USDA's National Veterinary Services Laboratories, Ames, Iowa.

Many families of exotic birds have been refused entry because they were infected with viruses that kill domestic poultry and other cage and aviary birds. The infections showed up during officially supervised quarantine.

More than 70 percent of the 221,600 birds refused entry into the United States from 1973 to 1981 because of disease were Psittaciformes--parrots, cockatoos, parakeets, conures, macaws, cockatiels and parrotlets.

However, infections were found in birds classified in 10 other families. These were the Fringillidae family--the finches and canaries; Sturnidae--mynah and starling; Cotingidae--cock of the rock; Corvidae--Magpie; Turdidae--Pekin robin; Ploceidae--silver bill; Columbidae--pigeon; Musophagidae--tuoraco; Gruidae--crane; and Phasianidae--pheasant and francolin.

The birds refused entry made up 147 lots out of 2,274 lots offered for importation. Lots varied from 10 to 36,800 birds. Of these, 141 lots were refused because they had exotic Velogenic viscerotropic Newcastle disease (VVND).

USDA veterinarians isolated many other viruses from the imported birds--paramyxovirus 2 and 3, influenza, psittacine herpes--Pacheco; pox, reovirus, and adenovirus. USDA veterinarians allow birds carrying these viruses entry because Federal regulations are designed to detect and exclude only viruses that kill domestic poultry.

USDA refused entry to the highest number of birds during 1973--the first year of the import bird program--when almost 32 percent of the lots and more than 40 percent of the birds were denied entry. Since then, fewer lots of birds have been refused.

The reduction may be due to factors like the following:

- Importers may have become more cautious in the types of birds they import and the countries from which they import them;
- The USDA 90-day ban on imports from countries when exotic Newcastle disease virus is isolated in birds from that country;
- The large number of birds imported from some countries may have reduced populations to the point where there is little disease left;
- Some importers may quarantine birds in the country of origin to eliminate lots with clinical disease. (APHIS News Center, 202 447-6315)

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APHIS [1]
Veterinarians
in Foreign
Countries [2] .

2
APHIS veterinarians are stationed overseas, a long way from home, to operate surveillance posts. These posts are designed to give an early warning of disease movements and help their host countries to prevent or stop disease spread.

APHIS has formal agreements with several foreign nations. These agreements are aimed at preventing the entry of foot-and-mouth disease, rinderpest, and other exotic diseases into the host country, to quickly detect the disease should it enter, and to provide for eradication should outbreaks occur.

These activities are carried out cooperatively by the APHIS veterinarian and a counterpart in the host country. Both countries provide funds for the program. APHIS provides technical equipment and the services of veterinary personnel. Expenses involve salary, local travel of U.S. personnel and reimbursement of the Department of State for support costs.

Activities include, but are not limited to:

Reporting vesicular diseases and rinderpest.

Investigating foreign animal disease outbreaks with counterparts to ensure that when suspected cases are reported, they are promptly investigated and diagnosed.

Visiting seaports, international airports, and border-crossing points to assure that they are being properly monitored through quarantine and inspection facilities.

Conducting seminars to train veterinarians and livestock inspectors in foreign animal disease recognition and diagnostic sampling procedures.

Conducting educational programs to make livestock owners aware of the cooperative program and the need to immediately report disease conditions to animal health authorities.

Meeting with animal health officials to discuss laws and regulations on indemnities, eradication procedures, and imports and exports of animals and animal products as they relate to the United States. These undergo changes throughout the year.

Developing practical plans for the immediate eradication of FMD and other exotic diseases should they be diagnosed in the host country.

Positions with veterinarians currently in place to perform these functions are located in Mexico City, Mexico; Guatemala City, Guatemala; Panama City, Panama; Tegucigalpa, Honduras; Bogota, Colombia; and Rome, Italy. APHIS also has veterinary personnel helping to establish a diagnostic laboratory in Mali, Africa. (APHIS News Center, 202 447-6315)

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Advisory Committee Meets [2].

The U.S. Department of Agriculture's Advisory Committee on Foreign Animal and Poultry Disease has strongly recommended that USDA take all possible precautions to prevent the introduction of causative agents of exotic animal diseases through imported meats and other products. At its meeting, October 13 to 14, 1982, in Hyattsville, Maryland, the committee reaffirmed its position that no animal product should be imported unless there is scientific proof that disease organisms found in the country of origin are no longer active in those products. Unsafe importations could seriously jeopardize the livestock industry of the United States, consumer supplies of domestic meat, other animal products, and the health of certain wildlife.

The committee also recommended that USDA include funds and plans for livestock repopulation when it considers assisting foreign nations in eliminating devastating animal diseases. The USDA is currently assisting the Haitian Government in eradicating African swine fever in that country.

The committee called upon APHIS to continue efforts to eradicate ticks from Puerto Rico and to assist in controlling ticks on other Caribbean islands. Ticks can spread heartwater, an African disease of cattle that was recently found on the French island of Guadeloupe in the Lesser Antilles.

USDA was also asked to strengthen the reporting of vesicular diseases such as vesicular stomatitis, which could mask an outbreak of foot-and-mouth disease. Approximately 500 cases of vesicular stomatitis were confirmed this past summer in livestock, horses and humans in 10 Midwestern and Western States, the most cases found in a year in recent history. Although not a dangerous disease in itself, vesicular stomatitis cannot be differentiated from foot-and-mouth disease except by laboratory tests.

The chairman of the advisory committee is Assistant Secretary of Agriculture C. W. McMillan. Harry C. Mussman, APHIS Administrator, is vice chairman.

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Advisory committee members are: Harold Neil Becker, Archer, Florida; Merlyn E. Carlson, Lodge Pole, Nebraska; Bert Hawkins, Ontario, Oregon; Frank A. Hayes, Athens, Georgia; John P. Kluge, Ames, Iowa; Latimer H. Turner, Sarasota, Florida; Neal F. Black, South St. Paul, Minnesota; Walter C. Cottingham, Kingstree, South Carolina; John R. Dahl, Gackle, North Dakota; Edgar M. Johnson, Rose Hill, North Carolina; Jack F. Rundquist, Butler, Illinois; Clarence Miller, Shelbyville, Kentucky; T. M. Weddle, Liberty, Kentucky; and Ralph Knobel, Fairbury, Nebraska. (APHIS News Center, 301 447-6315)

Teachers Seminar

Representatives from 26 colleges of veterinary medicine participated in an APHIS seminar for teachers of foreign animal diseases, August 31 to September 2, 1982, at College Park, Maryland.

The teachers were briefed on the status of exotic diseases of major concern and contingency planning related to them. Seminar participants then discussed the status of exotic diseases in veterinary college curricula, the related USDA research and regulatory programs, and VS resources available to them for instructional purposes. VS Emergency Programs, and other USDA resources and programs pertaining to foreign animal disease diagnosis, prevention, and eradication were also discussed. Foot-and-mouth disease and other vesicular diseases received special emphasis. Disease subjects covered in the seminar ranged from heartwater--recently diagnosed in the Caribbean--to exotic Newcastle disease in poultry and smuggled pet birds. The teachers were asked to identify educational subject areas for VS Emergency Programs cooperation. (Dr. S. T. Wilson, Jr., 301 436-8097)

World Situation

During the summer and early fall of 1982, the worldwide situation regarding animal diseases considered exotic to the United States remained fairly stable. Most of these diseases continued to occur in the areas in which they were reported in FAD Report 10-1. However, the following exceptions are noted:

African swine fever appears to have invaded Cameroon. Exact details are not yet known. American scientists are on site helping to define the situation and institute countermeasures.

Rinderpest was reported in Syria, causing concern to Israel and Lebanon. The disease apparently invaded Arabic countries with imports of live slaughter animals from Africa or India.

Foot-and-mouth disease reappeared in East Germany on two premises on which the disease was reported during an outbreak last spring. "Stamping out" procedures vigorously applied in Denmark appear to have been successful in preventing further outbreaks in that country. A serological survey conducted on slaughter animals did not reveal any sero-conversions.

Sweden joined the ranks of countries where **contagious equine metritis** has been diagnosed. (Dr. H. J. Seyffert, 301 436-8285)

Focus on... **Vesicular Stomatitis**

Its Cause, Characteristics, and Diagnosis

Vesicular stomatitis (VS) is a vesicular disease of cattle, horses, and pigs caused by viruses of the genus Vesiculovirus that are endemic in parts of Central and South America and periodically spread to North America. Humans are susceptible and develop an influenza-like illness. The Vesiculoviruses are members of the family Rhabdoviridae which also includes the genus Lyssavirus with its most prominent member, rabies virus. The family name is derived from the rodlike or bullet morphology of these viruses and is based on the Greek word rhabdos, a rod. The animal rhabdoviruses are better described as short, fat rods that are flattened on one end, truly a bullet-shaped virus.

Cause

The prototype virus is the Indiana strain isolated from vesicles of cattle at Richmond, Indiana, in 1925. Later a second serotype with different antigenicity was isolated in New Jersey. Viruses of similar structure and characteristics have been isolated from other parts of the world and may be roughly grouped into three basic serotypes:

New Jersey VS

Indiana VS

Indiana 1, Indiana strain

Indiana 2, Cocal and Argentina strains

Indiana 3, Alagoas and Brazil strains

Isfahan

Isfahan, Phlebotomus strain from Iran

Chandipura, human strain from India

Piry, opossum strain from Brazil

The Indiana 1 and New Jersey strains share a common antigen that can be detected with immunodiffusion precipitin tests. Cocal and Alagoas are closely related antigenically to the prototype Indiana. There is some disagreement as to the degree of relationship among Piry, Chandipura, and Isfahan.

These uniquely shaped viruses have a genome of single-stranded RNA arranged helically in a nucleocapsid surrounded by a protein shell with an external lipoprotein envelope. The dimensions of the VS virus are 65 by 185 nanometers, and it is inactivated by low pH and lipid solvents. The surface of the envelope is covered with little, 10 nanometer spikes. The composition of the envelope is complex, including five proteins, a lipid, and carbohydrate in the surface spikes. The virus is stable at a pH range of 4 to 10 and survives in soil at 4 to 6C for long periods. However, it is destroyed by exposure to 58C for 30 minutes and is inactivated by 1 percent formalin and other disinfectants.

Laboratory Hosts

Vesicular stomatitis virus replicates in a variety of cell cultures with a strong cytopathic effect. The virion matures by budding through cytoplasmic membranes. For isolation, primary swine kidney cell cultures are quite susceptible, while the

Vero-M (green monkey) cell line is more convenient for growth of the virus in neutralization tests. Another convenient laboratory host is the chick embryo, which uniformly succumbs to VS infection in 72 hours. Guinea pigs, hamsters, ferrets, mice, and chicks are susceptible to experimental infection. Cotton rats infected with New Jersey VS will die while those exposed to Indiana VS will survive.

Pathogenesis

In its natural hosts the virus replicates in the prickle cells of the Malpighian layer of the epithelium. Virions bud from the cell surfaces and infect neighboring cells. The cells shrink and degenerate. Transudates from the bloodstream increase in the intercellular spaces forming vesicles. At or about this point the viral infection becomes generalized, and the host animal becomes febrile. The vesicles enlarge and rupture. Erosions and ulcers are produced, and secondary infection may cause additional tissue destruction. Foot lesions may be severe, resulting in complete loss of the hoof.

Onset
and
Signs

The incubation period is usually 24 hours with experimental infection, but may require several days under natural conditions. Initially, excessive salivation with fever is observed. However, lameness may be the first sign observed in pigs. Raised, blanched areas on the tongue, lips, oral mucosa, snout, and coronary band become vesicles that rupture, leaving raw, denuded lesions. In dairy cattle, teat vesicles are a serious problem, leading to skin erosion, deep necrosis, and occasionally severe mastitis. Unless secondary infection occurs, the erosions heal quickly and recovery is complete in 2 weeks.

In spite of the obvious systemic nature of the infection, a viremia has not been detected in cattle, horses, or swine. Adult cattle are more susceptible, and lesions are seldom seen in cattle less than 1 year of age. Subclinical infections are common. Cattle that are sharing mangers and water sources with sick herdmates may fail to develop clinical signs. The mucous membranes or the skin must be penetrated to produce lesions of VS. Merely swabbing or spraying VS virus on intact epithelium may fail to infect. A feature of significance in distinguishing VS from foot-and-mouth disease (FMD) is the failure of vesicles to appear when VS virus is given to cattle intramuscularly or intravenously. However, infection is established by this route as confirmed by the production of complement-fixing and neutralizing antibodies.

Although the severity of the disease depends on the virulence of the particular strain of virus involved in the outbreak, serious economic hardship may occur due to weight loss and drop in milk production. Infection with New Jersey VS virus usually produces more serious disease than that with Indiana virus.

Diagnosis

The prompt diagnosis of this virus is crucial since VS infection in the field cannot be distinguished from FMD unless horses are involved. Even in the presence of lesions in both horses and cattle, consideration must be given to the possibility of dual infection. The differential diagnosis is performed by use of the direct tissue complement-fixation test to identify the

antigens of either VS or FMD. The viruses may also be isolated in cell culture and identified with fluorescent antibody conjugates. Serum antibodies are detected by use of the complement-fixation or neutralization tests.

CF Test
For Virus

Tissue Microtitration Complement-Fixation Test: This technique takes 3 hours and can be performed when the specimens arrive at the laboratory--at any hour, day or night. Vesicular epithelium is triturated in phosphate buffered saline, pH 7.6, to prepare a 20 percent suspension. The suspension is clarified by centrifugation. A preliminary titration is made to determine the degree of anticomplementary effect of the antigen. The minimal amount of complement that produces 100 percent hemolysis is multiplied by a factor of 1.7 to determine the amount to be used in the test with that antigen. The antigen is tested against New Jersey VS, Indiana VS 1 through 3, and seven polyvalent FMD antiserums. The polyvalent FMD antiserums are A, O, C, SAT 1, SAT 2, SAT 3, and ASIA 1. If insufficient antigen is available, Indiana VS subtypes 2 and 3, and the least likely FMD antiserums are deleted. Control antigens include New Jersey VS, Indiana VS, and normal tissue. The typing antiserums are placed in vertical rows of plastic U-bottom microtitration plates, and the tissue antigens are placed in duplicate horizontal rows. Appropriate controls are prepared. Complement is added to each well, and the plates are agitated and incubated for 1 hour at 37C. Sensitized erythrocytes are then added, and incubation at 37C is repeated for 30 minutes. After centrifugation the test is read. The hyperimmune guinea pig antibodies that are specific for the specimen antigen will fix the complement in the test wells.

FA Test

Direct Fluorescent Antibody Cell Culture Technique: A fluorescent antibody conjugate prepared with VS antiserum is used to stain coverslip cell cultures inoculated with specimen tissue suspension. Primary embryonic bovine kidney and swine kidney cells are prepared in Leighton tubes with coverslips, bovine for FMD and swine for VS. The clarified suspension, as prepared for the tissue CF, is inoculated into the Leighton tubes after the medium is discarded.

Specimens of oesophageal-pharyngeal epithelium obtained by means of a probang are diluted in an equal volume of medium, centrifuged, and the sediment is triturated in a TenBroeck grinder. The reconstitute is inoculated onto the cell cultures. The supernate may also be cultured.

The suspension is incubated in contact with the cell sheet for 1 hour at 37C, and then the cell sheet is washed with medium. Growth medium is replaced, and the cultures are incubated overnight. The coverslips are removed, fixed with acetone, and stained with the anti-VS conjugates. Positive virus isolation will be confirmed by the plaques of green fluorescing cells that are infected with VS virus. Fluorescence of virus-infected cells has been detected with only a few hours' incubation.

CF Test
For Antibody

Serum Complement-Fixation Test: Serums are tested in a microtitration system against normal, New Jersey, and Indiana antigens. Serum dilutions are 1:5 through 1:40.

Complement-fixation titers are detected in 5 to 10 days following infection and recede in 3 to 6 months. Initial reactions may be nonspecific or cross reactive, that is, reactive to normal antigen or reactive to both New Jersey and Indiana VS. The serum CF is useful when vesicular tissue cannot be obtained.

Virus
Neutralization

Neutralization Test (Nt): The serums are tested against New Jersey and Indiana VS in a microtitration system using the Vero-M (green monkey) cell line propagated in Eagle's medium. Serums are diluted 1:8 through 1:512. Titers of 1:8 and 1:16 are considered in the suspect range; 1:32 and higher is considered positive evidence of previous infection. Neutralization titers usually persist for several years. Low titers of 1:8 and 1:16 have been detected in animals without any history of clinical VS or habitation in VS endemic areas. Nonspecific neutralizing activity against VS virus in serum has been reported. A fourfold or greater increase in titers between acute and convalescent serums is diagnostic evidence of recent infection. Animals with Nt titers may be susceptible to reinfection and develop clinical signs. (Dr. E. A. Carbrey, 515 292-2404)

The Enigma of Vesicular Stomatitis

1982

It was really no surprise when vesicular stomatitis (VS) reappeared this year in Colorado. That State has figured in 11 of 30 outbreaks of VS in the United States and Canada, beginning in 1916 when it swept across the country from Virginia to Utah. At that time it was shown to be a specific disease entity by experimentally transmitting it from animal to animal. Events of the 1982 outbreak of VS in the United States are summarized above and in the September 1982 issue of FAD Report 10-2. It is noteworthy that the disease appeared nearly simultaneously in widely separated locations, without indication of its source or means of introduction. It first appeared in mid-July in the vicinity of Durango and Grand Junction, Colorado. These locations are 170 miles apart. At the same time it was found near Greeley, Colorado, 235 miles toward the East, across the Continental Divide.

History

Records indicate that what appears to have been VS was around for a long time before it was identified as a specific disease. During the Civil War in September 1862, General McClelland reported a most violent and destructive disease affecting nearly 4,000 horses. What may well have been VS appeared in South Africa in 1884 and 1887; in Maryland, Virginia, and Texas in 1889; in Eastern, Central, and Western States in 1904; and in horses in the Chicago stockyards in 1907. The disease occurred in horses shipped from many areas of the United States to France for military use from 1915 to 1917. Spread to domestic livestock was reported in that country. With VS widespread in the United States it is not surprising that it became a serious problem in stockyards, remount stations, and receiving points overseas where horses were brought together in large numbers. To pursue a possible pattern, there were 244 cases of VS in 5,000 horses assembled for military maneuvers in Louisiana and Texas during 1941, with the difference that the disease was not reported elsewhere in the United States during that year.

VS was identified in Argentina in 1939, Venezuela in 1941, and Colombia in 1943, when swine were among the species affected. It has long occurred in Mexico. When FMD broke there in 1946, Mexicans understandably thought it was VS with which they had long experience. Differential diagnosis of the two diseases was difficult throughout the Mexican FMD eradication program, 1946-1952, because of the necessity to rely on animal host-range susceptibility tests at that time.

The author's experience with VS was in Georgia, where the disease gave deep concern twice, 10 years apart. With the advent of FMD in Mexico and costly measures to eradicate it, the U.S. Bureau of Animal Industry developed stronger diagnostic capabilities and preparations to deal with possible outbreaks. This included beating the drums for early detection and investigation of all suspected foreign diseases. As a result of this effort, veterinarians and livestock owners in southern Georgia reported long time and rather frequent occurrence of a swine disease they called "red nose." The disease produced vesicles and inflamed erosions on the snout, mouth, and feet of affected swine. By 1952 animal inoculation tests proved "red nose" to be VS.

Many groups of test animals were required for differential diagnosis, one for each premises. Differential serology was not available. A test animal group consisted of susceptible animals inoculated with a suspension of lesion fluid and tissue. One equine and one bovine were inoculated by scarification of the tongue and two swine by scarification of the snout. In addition, one bovine was inoculated intramuscularly and kept in very strict isolation. The following table shows the susceptibility of each species and means of inoculations:

<u>Virus Inoculated</u>	<u>Means of Inoculation</u>				
	Scarification			Intramuscular	
	<u>Swine</u>	<u>Cow</u>	<u>Horse</u>	<u>Cow</u>	<u>Muscle</u>
	<u>Snout</u>	<u>Tongue</u>	<u>Tongue</u>		
Vesicular exanthema	+	-	+/-	-	
Foot-and-mouth disease	+	+	-	+	
Vesicular stomatitis	+	+	+	-	

+ = Susceptible +/- = slightly susceptible - = resistant

Test animals are no longer required for the differential diagnosis of VS because of the reliability of more rapid serological and virological methods.

A veterinarian who had seen "red nose" during the early years of the problem in the United States also reported lesions on the feet of deer.

Until 1952, vesicular exanthema (VE) was thought to be limited to swine in California. In that year, VE came out of California via garbage from a passenger train provisioned in California.

The garbage was unloaded and fed to swine at Grand Island, Nebraska. These swine were sold through the Omaha, Nebraska stockyards to many destinations, resulting in widespread outbreaks. Further outbreaks resulted from the feeding of garbage containing pork from infected swine that had been slaughtered before symptoms and lesions developed. The disease spread to 41 States and the District of Columbia. A total of 13 outbreaks occurred in Georgia.

Each subsequent time vesicular lesions were found in swine in southern Georgia there was alarm VE might be present, especially in wild swine of the swamps and coastal areas. These mingled with farm swine almost at will. The thousands of wild swine in the coastal areas of North Carolina, South Carolina, Florida, Mississippi, and Louisiana are largely of domestic type. In one instance at a fishing club on the Satilla River of southern Georgia, wild swine had been trapped and fed kitchen scraps. They subsequently developed very large vesicles on the snout. When used as inoculum, vesicles produced severe positive lesions on the tongues of cattle and on the tongues of ponies and snouts of swine.

To heighten the tempo in 1952, lesions were found in swine on the day before scheduled sale in a large livestock market in the town of Dublin in central Georgia. Erosions resembling those caused by vesicular disease viruses were also found in the mouths of the cattle. The sale was quarantined. Differential test animal results were confusing. Use of a second and third set of test animals also failed to give clear results. Approximately 300 swine and 200 cattle were held under quarantine at the market for more than 2 weeks while tests continued. Cleaning and disinfecting measures were strictly enforced to insure against the spread of possible FMD, VS, or VE. The owner of the market suffered a staggering \$40,000 loss in feeding these cattle and swine and in meeting severe sanitary requirements. A packing plant in Atlanta which had received and slaughtered cattle from this market was cleaned and disinfected, and the carcases from this source were retained for final diagnosis. Finally, the results of animal tests and serology done at the USDA laboratory in Beltsville, Maryland, confirmed a diagnosis of VS. Governor Herman Talmadge and Commissioner of Agriculture Tom Linder--supported by the members of the Legislature who understood the need--obtained a special \$40,000 appropriation in the next session of the Georgia Legislature to reimburse the market owner.

Only an occasional case of "red nose" was subsequently reported in southern Georgia until the summer of 1963 when the area southwest of Atlanta literally exploded with VS that affected thousands of cattle on hundreds of farms. Both beef and dairy herds were hit. Mouth lesions were often so severe that the inflamed areas extended into the throat, making even the swallowing of water difficult. Teat lesions were widespread and udder lesions as much as 4 inches in diameter were common. Lesions of the front feet were also common, particularly where saliva drooled on the feet. Temperatures were very high. Lactation stopped and usually did not return if the animals were past mid-lactation. Outbreaks in dairy herds were followed by

extensive numbers of mastitis cases, many of which were later culled from the herds. Many animals died from dehydration and debilitation. Practitioners made round-the-clock calls administering supportive therapy and antibiotics to control secondary infections. One dairyman with 75 percent of his milkers affected reported that average milk production dropped from 55 pounds to 30 pounds per cow and that it took a year to get his dairy back to full production.

A very valuable purebred Angus herd became infected. Its upcoming yearly sale had to be cancelled, adding to the owner's losses. Some other cattle lost as much as 300 pounds in body weight. Meetings were held with livestock producers to explain what was known about the disease and coordinate action. A vaccine, quickly prepared in Minnesota, was used in some uninfected dairy herds and was thought to elicit some resistance. Cattle in areas of Alabama adjacent to Georgia were also involved to a limited extent. This storm of VS faded in late August and September of 1963. In doing so it seemed to travel northward toward Tennessee. The penitentiary dairy herd located in south Atlanta was among the last to become infected and suffered severe lesions followed by widespread mastitis. VS in a much milder form occurred again sporadically in the same general area in 1964. Since then there has been no further reported occurrence in Georgia.

What happened in Georgia is offered to show what can conceivably happen in other locations. Interestingly, in this connection, VS has not been reported in the New England area, eastern Canada, or Alaska. The enigma of occurrence, natural spread from herd to herd and animal to animal, continues to be among nature's secrets.

This article would be remiss without strong appeal to all veterinarians and livestock people to report every situation having any possibility of being a vesicular or foreign disease outbreak to your State livestock health official or Federal veterinarian-in-charge immediately by phone. Diagnosticians with special training are ready 24 hours a day to investigate.

My thanks and admiration are extended to Dr. Robert P. Hanson, Department of Veterinary Science, University of Wisconsin, for his excellent extensive work with VS and for his "Natural History of Vesicular Stomatitis." (Adapted from an article written by Dr. C. J. Mikel, Oklahoma City, Oklahoma, 405 231-4335)

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